eggs one after another tranversely to the long axis of the body,avoiding the intersegmental regions and the tubercles. The eggs were laid singly but in instalments. In majority of the cases the eggs were glued side by side very near to each other (Fig. 1) with their micropylor end invariably pointing upwards. At each visit the fly laid one or more than one egg on the host. A maximum of 77 eggs were counted on the body of a healthy IV instar host. Perhaps, therefore, the superparasitism was very common in the tasar population.

Hatching of eggs: The eggs usually hatched in 3 days after deposition, i.e., in the present case they hatched in the last week of December. The percent hatchability was as high as 97.9 (ranging from 66.7 to 100) under laboratory conditions. A longitudinal slit was made on the attached surface of the egg extending up to 1/2 or 2/3 length from the micropylar end. And the tiny maggot penetrated directly into the host's integument through the slit. Soon the area around the point of entry of the maggot became black (Fig. 1). This black mark is the characteristic feature of uji fly infestation which can be utilized for diagnostic purpose. The egg shell remained attached to the integument of the host even after the death, decay and drying of the carcass of the silkworm.

G.M. PATIL
January 20, 1989. C.J. SAVANURMATH

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45. A CONTRIBUTION TO THE FLORA OF GANGANAGAR (RAJASTHAN)

INTRODUCTION

Ganganagar is situated in the north of Rajasthan State between 28° 40' and 30° 06' N Lat. and 72° 36' and 75° 30 E Long. It constitutes a part of the Great Indian Desert. The Gang canal drawing water from the Sutlej river was launched in the year 1927–28, which has greatly changed the face of the area. The irrigation waters, which owe their source to the Punjab rivers, have been bringing seeds and other propagules of a number of extra–limital species year after year and many of these have already become successfully established in the area as crop weeds or along the banks of canals (Dhillon and, Bajwa 1969, Dhillon and Bhandari 1974, Singh and Brar 1984). The most striking example of this naturalization of Himalayan plants in the Great Indian Desert are species of *Riccia, Marchantia* and *Ophioglossum vulgatum* L. (Singh and Brar 1980) which are found frequently in the canal irrigated areas, showing thereby the extent to which plants from the Himalayas and other places have become naturalised in the irrigated desert.

There are no rocks or gravelly soil in the district. In the irrigated tract, soil under irrigation by Gang canal and Bhakra canal are sandy–loam. In the non–command areas, sandy plains with stabilized and shifting sand dunes are a common sight in the South of the district and its adjoining districts Churu and Bikaner of Rajasthan. There is a seasonal river called Ghagger which enters the tehsil Tibbi in the East and through Anupgarh flows to Pakistan. The soil in the bed of this river is heavy clay. There are some saline areas near Jetsar and Anupgarh where a few halophytes occur. The average annual rainfall is less than 300 mm. The rainy months are June to september with maximum rainfall in July—August. The summers are extremely hot and winters severely cold. The maximum and minimum average temperatures recorded are 44° C and 5° C, respectively.

We are presently working on the flora of North Rajasthan. While studying the specimens, we found some of these were not reported previously from Rajasthan desert (Blatt. and Hallb. 1918—21; Puri *et al.* 1964, Bor 1960, Bhandari 1978, Sharma and Tiagi 1979), therefore, new extrants to the desert. The specimens have been preserved in the Herbarium, Department of Botany, SGN Khalsa College, Sriganganagar, Rajasthan.

RESULTS AND DISCUSSION,

The vegetation of the area explored can be divided into:

(1) vegetation of loose sand dunes and sandy regions,

(2) vegetation of stablized sand dunes

(3) vegetation of Ghagger Alluvial plains,

(4) weeds of winter season

(5) weeds of rainy seas on,

(6) vegetation along canals,

(7) aquatic plants,

(8) Common parasites are *Cistanche tubulosa, Orobanche aegyptiaca, Striga angustifolia, Cuscuta reflexa, C. capitata* on *Medicago sativa* and on the species of *Tribulus* and *Zaleya.*

Total number of wild species so far collected is 487, belonging to 305 genera covering 82 families. In the present work, flora of an area of about 20,648 sq.km of northwest part of Thar desert, which is now under irrigation by network of canals system, has been studied and compared with that of non–irrigated regions of the area. A comparison of the vegetation of the hitherto unirrigated areas and that of the irrigated regions of the district of Ganganagar shows that irrigation has brought about remarkable changes in the composition of the original flora, both by way of new introduction as well as elimination of many of the original species. In comparison to the natural flora of the Thar desert (unirrigated parts only), the following species are new introductions in the irrigated regions.

1. *Ranunculus cantonenesis* DC.
2. *R. sceleratus* Linn.
3. *Nymphaea stellata* Willd.
4. *Nelumbo nucifera* Gaertn.
5. *Argemone ochroleuca* Sweet
6. *Dilophia salsa* Thoms.
7. *Farsetia jacquemontii* Hook.f.*et* Thoms.
8. *Malcolmia africana* R. Br.
9. *Hypecoum procumbens* Linn.
10. *Oligomeris linifolia* (Vahl) Macbride
11. *Arenaria serpyllifolia* Linn.
12. *Vaccaria pyrimidata* Medik.
13. *Portulaca grandiflora* Hook.
14. *P. pilosa* Linn.
15. *Oxalis latifolia* H.B. & K.
16. *Astragalus subumbellatus* Klotzsch
17. *A. tribuloides* Del.
18. *Lotus corniculatus* Linn.
19. *Medicago minima* Lamk.
20. *M. lupulina* Linn.
21. *Trigonella hamosa* Linn.
22. *T. pubescens* Edgew.
23. *Myriophyllum spathulatum* Blatt.*et* Hallb.
24. *Anethum graveolens* Linn.
25. *Ammi majus* Linn.
26. *Centella asiatica* (Linn.) Urban
27. *Oenanthe javanica* (Bl.) DC.
28. *Psammogeton canescens* (DC.) Vatke
29. *Trachyspermum ammi* (Linn.) Sprangue
30. *Carthamus oxycantha* Beib.
31. *Cirsium wallichii* DC.
32. *Cichorium intybus* Linn.
33. *Cotula anthemoides* Linn.
34. *Lactuca scariola* Linn.
35. *Parthenium hysterophorus* Linn.
36. *Soliva anthemoides* (Juss.) R. Br.
37. *Sphenoclea zeylanica* Gaertn.
38. *Gastrocotyle hispida* (Forsk.) Bunge
39. *Heliotropium currasavicum* Linn.
40. *Cuscuta capitata* Roxb.
41. *Lycium europaeum* Linn.
42. *Antirrhinum orontium* Linn.
43. *Majus pumilus* (Burm.f.) Steenis
44. *Verbascum thapsus* Linn.
45. *Orobanche aegyptiaca* Pers.
46. *Utricularia inflexa* Forsk.
47. *Lantana camara* Linn.
48. *Salvia plebeia* R. Br.
49. *Plantago amplexicaulis* Cav.
50. *Kochia indica* Wt.
51. *Chrozophora oblongifolia* (Del.) A. Juss.
52. *C. prostrata* Dalz.
53. *Euphorbia helioscopia* Linn.
54. *E. parviflora* Linn.
55. *E. serpens* H.B.E.
56. *Pouzolzia pentandra* (Roxb.) Benn.
57. *Polygonum lanigerum* R. Br.
58. *Ficus palmata* Forsk.
59. *Commelina diffusa* Burm.f.
60. *Lemna trisulca* Linn.
61. *Carex fedia* Nees
62. *Cyperus exaltatus* Retz.
63. *Eleocharis dulcis* (Burm.) Henschel
64. *Fimbristylis diphylla* (Retz.) Vahl
65. *F. woodrowii* Clarke
66. *Pycreus polystachyus* Beauv.
67. *Aristida plumosa* Linn.
68. *Catabrosa aquatica* (Linn.) P. Beauv.
69. *Crypsis schoenoides* (Linn.) Lamk.
70. *Dichanthium odoratum* (Lisboa) Jain
71. *Digitaria bicornis* (Lamk.) Roem.
72. *D. stricta* Roth *ex* Roem.
73. *Diplachne fusca* (Linn.) P. Beauv.
74. *Eleusine indica* (Linn.) Gaertn.
75. *Eragrostis nutans* (Retz.) Nees *ex* Steud.
76. *Koeleria argentea* Griseb.
77. *Leptochloa phleoides* (Vill.) Reichb.
78. *Lolium temulentum* Linn.
79. *Leptochloa chinensis* (Linn.) Nees
80. *L. pumila* (Desf.) Bor
83. *P. psilopodium* Trin.
84. *P. repens* Linn.
81. *Panicum austroasiaticum* Ohwi
82. *P. miliaceum* Linn.

85. *Phalaris minor* Retz.
86. *Setaria homonyma* (Steud.) Chiov.
87. *Sporobolus indicus* auct. non (Linn.) R. Br.

Thus, out of 410 naturalized species of the area, 87 are new entrants in comparison to the flora of the unirrigated desert regions. This means that irrigation over the last 60 years or so has apparently changed about 21 per cent of the species of the natural flora. This is too superficial a judgement since the real change is much more and not easily comprehensible. Some of these new extrants are temperate Himalayan plants such as *Cotula anthemoides, Arenaria serpyllifolia, Astragalus subumbellatus, A. tribuloides, Ammi majus, Trachyspermum ammi, Cichorium intybus, Soliva anthemifolia, Verbascum thapsus, Plantago amplexicaulis, Pouzolzia pentandra* etc. Still many of them are abundant in the cooler regions of Punjab. It is therefore obvious that their seeds have been transported by irrigation waters. Further, protracted irrigation has brought about so much amelioration in the climate that it is already supporting luxuriant growth of such arborescent forms of humid tropics such as *Bambusa*. Many other tree species such as *Dalbergia sissoo, Cordia dichotoma, Jacaranda mimosefolia, Kigelia pinnata, Emblica officinalis*, several species of *Ficus, Morus* and *Phoenix* are doing well in the area.

The natural flora has been modified in another way. Many of the common species of the unirrigated desert which originally belong to this area have disappeared obviously due to protracted irrigation, most probably due to losing competition against the new extrants. Though irrigation has effected the water contents and texture of the soil substantially, not all the changes are for the worse and the floristic richness can be attributed to irrigation alone. With the availability of irrigation, large tracts are now under cultivation and wastelands have become scarce. Wild species can grow only as crop weeds which are regularly removed by the farmers from their fields or on the sides of the roads and canals. This reduction in the realm of wild plants has obviously contributed substantially to the reduction in the number of wild species. However, whatever might be the factors responsible for the change of the natural flora, they are all consequent to the introduction of irrigation.

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46. *PNEUMATOPTERIS NUDATA* (ROXB.) PUNETHA ET KHOLIA COMB. NOV.

(With eleven text–figures)

INTRODUCTION

During our studies on the taxonomy of ferns of Pithoragarh district of Kumaon (N.W. Himalayas), we observed that at least in the fresh specimens of *Pneumatopteris nudata* (*Pronephrium nudatum* (Roxb.) Holtt.) the acrophores at the base of basal pair of pinnae are quite distinct and at least the lowest pair of pinnae is